

**Thurston County Light Industrial
Jenks Property Due-Diligence Investigation
Civil Elements - 4 December 2003**

DEVELOPMENT COST SUMMARY

	<i>Low Estimate</i>	<i>High Estimate</i>
Hydrogeologic Investigation	\$100,000	\$200,000
Clearing and Grading	\$ 80,000	\$ 130,000
Paving and Grading	\$650,000	\$650,000
Frontage Lighting	\$ 55,000	\$ 55,000
Frontage Improvements	\$ 340,000	\$ 340,000
Traffic Mitigation	\$ 200,000	\$ 400,000
Sanitary Sewer Installation	\$ 62,000	\$ 90,000
Sanitary Sewer Fee	\$ 20,000	\$ 30,000
Water Installation	\$ 100,000	\$ 100,000
Water Fee	\$ 20,000	\$ 30,000
Fire Suppression Supply	\$ 300,000	\$ 750,000
Stormwater Treatment	\$ 13,000	\$ 13,000
Stormwater Disposal	\$ 50,000	\$ 110,000
Stormwater Mitigation Project	\$300,000	\$ 500,000
TOTAL	\$2,300,000	\$3,400,000

SOILS AND CONSTRUCTION IMPLICATIONS

The site is currently covered with second growth forest (predominantly Douglas Fir). The understory is dense, healthy, and almost entirely native species, including Knickknick, Salal, Oregon grape, Evergreen huckleberry, sword ferns, and a variety of mosses. Very little Scotch Broom, moderate amounts of European bramble, and no Himalayan blackberry was found in the areas where test pits were dug.

Most of the site area will be required for site and frontage improvements, so it is estimated that 90% of the site will be cleared and grubbed, waste products chipped and stockpiled, and topsoil stockpiled. Clearing and grubbing costs are expected to be \$60,000 to \$100,000, taking into consideration the commercial value of the timber. Topsoil removal and stockpile will cost \$10,000 to \$15,000. Sediment control measures are expected to cost \$10,000 to \$15,000.

Native plant salvage operations are strongly recommended before clearing begins.

The gravel layer underlying the entire site conveys stormwater from off-site contributing areas across the site. Interception drains will be required around all above- and below-ground structures.

Soil Survey

The Soil Survey of Thurston County, Washington, published in 1982 by the United States Department of Agriculture, identifies the soil on this site as Alderwood gravelly sandy loam, 3 to 15 percent slope.

"This moderately deep, moderately well drained soil is on glacial till plains. It formed in ablation till overlaying basal till.... Typically, the surface layer is very dark brown gravelly sandy loam about 6 inches thick. The upper 9 inches of the subsoil is dark brown gravelly sandy loam. The lower 15 inches is dark brown very gravelly sandy loam. A weakly cemented hardpan is at a depth of about 30 inches. It is strongly compacted and crushes to very gravelly loamy sand. Depth to the hardpan ranges from 20 to 40 inches. ...

Permeability is moderately rapid above the hardpan ... and very slow in the pan. Available water capacity is low [bad for landscaping]. ... A perched seasonal high water table is at a depth of 18 to 36 inches from November to March. ... Runoff is slow and the hazard of water erosion is slight.

The main limitation [affecting structural construction] is the seasonal wetness. This soil can support large loads. A drainage system should be installed on sites for buildings with basements or crawl spaces.

Preserving the existing plant cover during construction helps to control erosion. Topsoil can be stockpiled and used to reclaim areas disturbed during construction... In summer, irrigation is needed for [landscaping].

The main limitations on sites for septic tank absorption fields [similar for stormwater infiltration facilities] are the hardpan and the seasonal wetness. Because of the restrictive layer, onsite sewage disposal systems often fail or do not function properly during periods of heavy rainfall. ..."

Table 9 reports that the potential for wetland plants and shallow water areas is very poor - not good from a habitat point of view, but reassuring to a developer.

Table 12 reports that the soil is not really suitable for structural fill, but will be satisfactory under pavement. Under structures, it is estimated that imported granular fill will be required for two feet under the footings. With a building area of about 125,000 SF, this is 9,260 cubic yards of imported fill.

Table 14 reports that the soil has between 10% and 35% fines, with a liquid limit between 15-25%. Table 15 reports that 5-10% is clay. This means that the soil will be moisture sensitive, and design of pavement bases must take this into consideration. A crushed base should be at least 6 inches thick. 353,572 SF of ACP with such a base will cost approximately \$650,000.

Table 17 reports that the cemented pan is thin (less than 60 inches deep). City of Lacey confirms that punching through the pan for stormwater infiltration and groundwater recharge will be allowed. We need to keep such facilities wider than deep to avoid having them be an underground injection well as defined by the Department of Ecology. If this pan is less than 48 inches thick, it is economically viable to dig it up and out. Extensive geotechnical investigation will be required to confirm this.

Geologic Factors

The Geologic Folio of the Olympia-Lacey-Tumwater Urban Area, Washington: Liquefaction Susceptibility Map, January 1999, published by Washington State Department of Natural Resources, indicates that this site has a very low liquefaction susceptibility

On-Site Investigation

Anna Crickmer, HQ Facilities Civil Engineer, and Doug Pierce, HQ O&M Environmental Manager, dug six test pits on site on 3 December 2003 between 9:30 AM and 11:30 AM. Weather at the time was clear and sunny changing to overcast, and the site had no standing water, in spite of very heavy rains lasting until about 9:00 PM on 2 December.

Two pits were dug in the western (bottom) third of the property, two in the middle, and two at the eastern boundary, near Marvin Road. All the test pits showed a layer of topsoil 6 to 9 inches thick over a reddish sandy loam with cobbles from 24 to 30 inches thick, over a sandy silty gravel layer 10 to 12 inches thick over hardpan as described in the county soils report.

In the pits closest to Marvin Road (at the higher elevations of the site), the soil was moist but not wet to hardpan. In the middle pits, water seepage was found in the gravel layer over the hardpan. In the lower (eastern) pits, water was flowing at a rate of approximately 2.4 inches per hour (see below).

One of the western-most pits (at the second lowest elevation) was excavated to a depth of about 12 feet. The soils encountered were 6 inches topsoil, 30 inches loam, 1 foot gravel, 8 feet of hardpan. The back-hoe was unable to dig deeper, but the operator reported slightly softer soils at the bottom of the pit. However, this layer also appears to be fairly impervious, as water seeping to the bottom of the pit collected with no indicated of infiltration.

The pit, as completed, was approximately 12 feet long and 3 feet wide at the surface, with a 3 foot square bottom. It was left open while the other pits were excavated and backfilled. In 30 minutes, water approximately 1 foot deep had collected in the bottom of the pit.

Other than the topsoil, materials on site, including broken hard-pan, will be suitable for structural fill and trench backfill within a foot of the bottom of the structural footing or pavement base. The hardpan should not add significantly to utility installation costs.

TRANSPORTATION

Marvin Road is a major arterial under the jurisdiction of the City of Lacey. Marvin is also a Class II bikeway. 32nd Avenue NE is a local collector street.

Required illumination:

Average maintained horizontal illumination is 1.4 foot-candles in industrial areas. Uniformity ratio is 3:1. Dirt factor 0.85, lamp lumen depreciation factor 0.73, minimum weak point light 0.2fc. Average illumination at intersections (such as at 32nd) must be 1.5 the illumination required on the more highly illuminated street, or 2.1fc in this location. There are a set of standard poles and luminaires acceptable for use (see City of Lacey standards).

40-foot poles are required on arterial streets, such as Marvin Road. 400-watt luminaires are required. Maximum spacing of light poles is 240 feet. Given the frontage distance of 1600 feet on Marvin Road, 7 poles will be required, one at the intersection, one at each end of the frontage, and two evenly spaced between the ends and the intersection. Aluminum poles with concrete base, high pressure sodium fixtures, and arm brackets cost approximately \$5,500 each, including power installation. Lighting cost on Marvin Road is \$38,500.

30-foot poles may be used on 32nd; 200-watt luminaires may be used; and maximum spacing on 32nd Avenue NE is 190. Given the frontage distance of 800 feet on 32nd, 5 poles will be required; one at the end of the frontage, one at the entrance and three others evenly spaced. These light poles will cost approximately \$5,000 each, including power installation. Lighting cost on 32nd is \$15,000.

Frontage Improvements

Standard Section 4-2B defines the improved section (centerline to edge of right-of-way) for an arterial as 24'-30' paved lane, a bike lane, curb and gutter, a 7-foot planting strip behind the curb, a 6'-8' sidewalk, and a 10-foot cleared utility easement. Marvin is a Class II bikeway, which means that the bike lane must be 6' wide.

The roadway in front of the Target complex to the north of the site is fully improved, and has lanes 24 feet wide, with a turn-lane in the middle. The turn-lane is protected from through traffic by islands. From the intersection at 32nd Avenue NE, it can be seen that the improved portion of the roadway is markedly farther west than the western half of the existing unimproved roadway. Sidewalks were placed on the east side of the road.

The roadway in front of the business park in which Fed Ex is located, south of the site, has half-road improvements, with a pavement width that will allow a center turn lane at some future date, as well as providing space for a bike lane. Sidewalks were again placed on the east side of the road.

It is safe to assume that a left-turn pocket will be required onto and off of 32nd Avenue NE for any development of the Jenks property. A 100-foot long pocket with a 40-foot taper is assumed, with a lane width of 15 feet.

The existing roadway along the Jenks property Marvin Road frontage is 24 feet wide, fog-line to fog-line. Approximately 3 feet of paved shoulder is available. Power and phone lines on overhead poles run on the west side of the road. The 14" ductile iron water main runs on the east side of the road and has hydrants installed.

The improvement section is assumed to start the required north-bound lane on the existing east-side fog line, based on the location of the fire hydrants and of the improvements in front of the Target complex.

A saw-cut line 1600 feet long will cost approximately \$3,200. Approximately 5,000 SF of existing pavement will have to be demolished, for a cost of about \$3,000. Nearly 50,000 SF of new asphalt will be required, at a cost of about \$50,000. Paving on the arterial must be at least 0.5 feet of ACP over a base approximately 2.25 feet thick. A full-width overlay with level course along the entire frontage will be required at a cost of about \$88,000. Curb and gutter will cost approximately \$10,000, and sidewalk approximately \$27,000.

A stormwater system is required. We should propose a modified "Spokane" approach, which directs the public pavement to a vegetated swale via a depressed curb or curb cuts, planted with water-tolerant vegetation. Catch basins can be installed in the vegetated strip, and the piped system discharged to a public stormwater facility. Maximum catch basin spacing on arterials is 300 feet, so at least six will be required on Marvin Road. The cost of stormwater improvements along Marvin Road will be approximately \$20,000.

Because of the number of people at this facility, we may be required to install a bus stop with a passenger shelter. Street trees, landscaping, and irrigation will be required as well. Power and phone lines must be moved underground. Cost of miscellaneous frontage improvements is approximately \$75,000.

Driveways giving direct access onto arterials may be denied if alternate access is available. If allowed, the driveway must be at least 150 feet from the intersection, and at least 75 feet from any other driveway along the arterial. A fire access onto Marvin would be a good idea, but ordinary traffic should be routed onto the site via 32nd Avenue NE.

Standard Section 4-3 defines the full-width improved section for a commercial collector as (from centerline to edge of right-of-way) 20' paved lane, curb and gutter, a 7-foot planting strip behind the curb, a 6'-8' sidewalk, and a 10-foot cleared utility easement.

Existing pavement on 32nd Avenue NE is 23 feet wide, with narrow crushed surfacing shoulders. It has a fairly recent chipseal surface, and has no striping. The 12" PVC waterline runs on the north side of the street along the full frontage of the Jenks property at a distance from the edge of pavement of about 20 feet. Power and phone lines are on poles on the south side of the street and must be relocated underground. It is expected that frontage improvements will start at the existing centerline, and include 7,200 SF of new asphalt (\$8,000), 25,000 SF of overlay with level course (\$20,000), 800 LF of sawcut (\$1,000) and 400 SF of ACP removal (\$1,000), 800 LF of curb and gutter (\$5,000), and 6400 SF of sidewalk (\$13,500). The cost of stormwater and other utility improvements along 32nd Avenue NE will be approximately \$11,500.

Total estimated frontage improvements costs for the site is approximately \$340,000.

Thurston County is reluctant to estimate traffic mitigation fees and concurrency project shares without a formal traffic study. Such costs have been as high as \$350,000 for other projects in the area, not including the Target complex, which paid for a round-about. Although the County will not make a decision at this stage of planning, it is not likely that a round-about will be required in this location, because 32nd Avenue NE is not a major through-way.

Discussion with the City and County about frontage improvements may allow us to provide "in-kind" mitigation and concurrency improvements, such as full-width improvements (connecting sidewalks on the east side to the north and south).

PUBLIC UTILITIES

Sanitary Sewer

The sewer utility requires that developers install sewer lines "to and through" the property being developed, to allow use of the line by other properties in the area. The sewer line must therefore be developed with the maximum built density of the potentially contributing lots in mind.

In the absence of population figures, an estimate of sanitary sewer loading can be made by using a figure of 300 gallons per day (gpd) per 1000 square feet (sf) of gross floor area, for commercial/light industrial facilities.

The sites that might contribute to any line put in for the Jenks property are all zoned business or light industrial, and both zoning categories allow a maximum floor ration (the gross floor area divided by the area of the lot) of 0.40. The total area of these sites is 33.39 acres. Multiplied by 43,560 sf per acre and 300 gpd/1000sf gives a daily average flow of 174,536 gallons per day.

Alternatively, the City of Lacey requires a planned loading of not less than 400 gallons per capita per day (gpcd) for the site. WSDOT development plans involve 369 staff members based at this site, which gives a daily average flow of 147,600 gpd.

Because the area-calculated loading is more conservative, it is the figure used for this report.

An average daily flow of 174,536 gpd is 102.5 gallons per minute (gpm) or 0.23 cubic feet per second (cfs). Standard industry peak flow factors are 150% of average flow for commercial areas, and 300% of average flow for laterals. Using the most conservative figure, the design flow (daily peak flow) is calculated to be 0.685 cfs.

The smallest, shallowest lateral allowed by the sewer utility is an 8-inch line with a slope of 0.004 ft/ft. This size line, when flowing full, can pass 0.78 cfs. An 8-inch line is large enough to pass the peak flow of all possible contributing areas.

There are two sewer lines within a reasonable distance of the site to which this line could connect, one on the north end of the Jenks property, and one approximately 1200 feet south of the Jenks property.

The first, which is within the site's Sewer Basin (as defined by the Utility), is the 10-inch lateral installed by the Target complex. The end maintenance hole (MH) of this line is at the northern tip of the northern section of the Jenks property, approximately 5 feet into the pavement of the west side of Marvin Road.

A line to and through the Jenks property (i.e. extending from the southern boundary of the property to the existing MH) would be approximately 2,150 feet long, with a fall of 8.6 feet over that distance. Average elevation on site is 208, estimated finished floor elevation would be 210, so the terminal invert elevation would have to be 196.4 or less. The actual invert of the existing MH is 203.6, so this line is not accessible by gravity. A gravity line along Marvin Road from the southern boundary of the property to 32nd, a grinder/ejector lift station at that point, and pressure line to the existing MH would cost approximately \$62,000, and has very little uncertainty.

The second sewer line to which the Jenks Property could connect is an 8-inch line to the south. This line is outside the Jenks Property's "sewer basin", but the utility confirms that connection would still be allowed. A line from 32nd Avenue NE to this point would be about 2000 feet long. Distance from the center of the site to the existing MH is also about 2000 feet long, requiring a fall of 8 feet over this distance. The existing MH, in the center of Marvin Road, has an invert elevation of 199.6, which means that a gravity connection could be made if the building finished floor elevation were 212.6 or higher, or almost 5 feet higher than the average site elevation.

However, the existing 8" line would not be large enough to handle both the existing load and the proposed added load, and approximately 1000 feet of active line would have to be

replaced with 10" line. Depending on the cost of street repair, this alternative would cost between \$65,000 and \$90,000. Because this line would cross many other parcels and connect to a line with multiple service connections, the risk and uncertainty is much greater than for the first alternative.

On-site lateral connections would add approximately \$5,000 to each alternative. The utility does not want to calculate system development charges at this stage of planning. At other locations, these charges have been from \$20,000 to \$30,000.

Water System

A 14-inch ductile iron line with hydrants has been installed on the east side of Marvin Road, and a 12" PVC branch with hydrants has been installed on the north side of 32nd Avenue NE to and through the Jenks property. The owning utility is the City of Lacey. Existing fire flow in the area is 3000 to 4000 gallons per minute. None of the existing hydrants will provide fire protection for buildings on the Jenks properties. It is assumed that a 12" loop will be installed on the property, with hydrants installed. Domestic, process, and irrigation connections can be made to the existing 12" line or to the proposed 12" loop.

From the 1997 UFC, a building with an area of 124,589 SF and Type V-N construction requires 8,000 gpm for 4 hours; Type II-N or III-N construction requires 7,500 gpm for 4 hours. 8 hydrants installed not more than 200 feet apart are required.

The piping system alone will cost approximately \$100,000 to install, including work in the right-of-way and traffic diversions. The utility does not want to calculate system development charges at this stage of planning. At other locations, these charges have been from \$20,000 to \$30,000.

To provide the appropriate fire flow, pumps and storage tanks holding 1.2 million gallons will have to be provided. The Target warehouse site has two steel ground tanks near the entrance to the site.

One alternative measure for providing this volume of water is to collect roof runoff directly into ground tanks. Average precipitation in the Lacey Area is 51 inches per year. With a roof area of 124,589 SF, this would produce 529,503 SF (nearly 4 million gallons) per year, far in excess of need. Overflow from the tanks would flow to the stormwater management system.

Steel ground tanks with a fire pump assembly would cost approximately \$750,000 to install. The certainty that this system would be approved is more than 90%. (Underground tanks would cost more than \$1.5 million, as would elevated tanks.) An in-ground lined pond 10 feet deep (9 feet of water and 1 foot freeboard) with side slopes of 1V:3H would require a top width of 86 feet. The cost of construction (excavation, spoil on site, liner installation, and pump assembly) would be approximately \$300,000, and the certainty that this system would be approved is 50%.

Stormwater Management

Stormwater Treatment

A planning estimate of impervious surface provided 353,572 SF of pollution-generating impervious surface (asphalt pavement for parking and circulation) and 43,560 SF of crushed surfacing laydown area. As a rough estimate of treatment requirements using a wetpond, the two-year, 24-hour precipitation figure was multiplied by the sum of these two areas, indicating a need for a treatment pond with a volume of 82,736 cubic feet.

If the pond were arranged with its length north and south, it could be about 500 feet long. With a minimum depth of water of 3 feet, a foot of freeboard, and a side slope of 1V:3H, the top width of the pond is 70 feet.

This pond must be lined. Previously constructed treatment ponds in the area have used a clay liner, which has been insufficient to contain the water. A gunnite liner would cost \$8.50/SF, and a geotextile liner \$2/SF. For the estimated treatment pond, the geotextile liner would cost \$70,000 installed. The earthwork involved in excavating the pond (4,300 CY) would cost \$13,000 if the material were spoiled on site. Some material would be replaced in the pond to maintain vegetation to aid in the treatment process.

Stormwater Disposal

The total area contributing runoff is 521,721 SF. The 100-year, 24-hour event precipitation figure is 5 inches, which would produce runoff volume of 217,384 CF (1.6 million gallons).

The soil above the hardpan will be saturated, and there is no indication at this time that soils able to infiltrate stormwater exist below the hardpan. Some water may be discharged through the gravel layer directly on top of the hardpan, but this will be a small portion of the total volume collected. Stormwater must be discharged off site, so detention facilities will be required. Because the surface soils are currently transmitting water from off-site, facilities will be required to manage two back-to-back events.

A pond 10 feet deep with a top width of 115 feet and side slopes of 1V:3H and a length of 500 feet will hold the runoff of two 100-year events. Such a facility will cost approximately \$50,000 to excavate if the material is spoiled on site. Such a facility will be considerably wider at the surface than it is deep, and will not be considered an underground injection well.

A detailed hydro-geological investigation, conducted in coordination with Thurston County and City of Lacey staff, will be required to establish a stormwater management strategy, which may include under-pavement drains or other new management practices. This investigation will cost between \$100,000 and \$200,000, and mitigation will cost between \$300,000 and \$500,000. (The inadequacy of the state-of-the-art facilities at the

Target complex will have sharpened jurisdictional interest in this aspect of site development.)

Preliminary flow diagrams show approximately 37 acres off-site contributing area. Most of this area is currently pasture, or is developed (and presumed to have its own stormwater management system). A detailed runoff analysis will be required to determine the volume capacity of on-site conveyance facilities.

Facilities that restrict outflow will add \$15,000 to the pond cost. Connection to existing County stormwater conveyance systems will require construction of piped systems (approximately 1000 LF, costing \$25,000) and will require a connection fee of about \$20,000.

The stormwater charge for this area is about \$6/1000 SF/YR of impervious surface, or about \$2,400 annually for this site.

Power and Communications

Power and Communication is available on both Marvin Road and 32nd Avenue NE. The major cost for these systems is the relocation of the existing lines to underground facilities, which has been included in the Transportation section, above.